



MEMORANDUM

To: CMAP Environment and Natural Resources Committee

From: CMAP Staff

Date: January 27, 2016

Re: Improvement of Environmental Evaluation of Major Capital Projects

In past evaluations of capital investments, CMAP has estimated both environmental and economic impacts of candidate transportation improvements. As part of a larger effort to improve project evaluation, CMAP reviewed past methods for calculating environmental impacts and is recommending updates for future capital project evaluations for discussion by the Environment and Natural Resources working committee.

Past Methods

For the major capital element of the GO TO 2040 update, CMAP evaluated the benefits of proposed capital projects to help prioritize them for inclusion within the plan's fiscal constraint.¹ In terms of environmental measures, three main impacts were evaluated:

- **Environmental Justice:** examined whether the jobs-housing access measurement showed improvements in access to jobs by auto or transit for disadvantaged communities as a result of the project. Disadvantaged communities were defined as those census tracts where median income is less than half of the regional median income or where more than half of the population is minority.
- **Air Quality:** measured as the change in carbon emissions equivalent emitted by the transportation system in the region, in tons per year, as a result of the project. On top of this, CMAP also demonstrates regional air quality conformity for the pollutants for which the region is in non-attainment.
- **Natural Resource Preservation:** CMAP uses the regional travel demand model to estimate a project's potential impact to the transportation network; specifically the change in the

¹ For more information on this evaluation, see the major capital projects appendix of the GO TO 2040 plan update:

<http://www.cmap.illinois.gov/documents/10180/332742/Update+Major+Capital+Projects+FINAL.pdf/51a1943f-0c2d-4243-8d94-9232f4598566>

relative accessibility of each of the model's subzones, quarter-section sized geographies that CMAP uses for household and employment forecasting. The change in accessibility is used to estimate the number of new households and businesses likely to locate in those areas. Overlaying this additional development with information about regionally-significant green infrastructure provides a measurement of a project's impact on terrestrial environmental resources.² To evaluate the impact of development on the region's water resources, CMAP estimates the amount of new impervious surface created by the transportation project itself as well as by the projected spinoff development.³

Recommended Changes

CMAP staff reviewed peer MPOs, newly available data, and other resources to determine if updates could be made to the existing evaluation of environmental impacts. Four potential improvements were identified along with several future research needs:

1. Include impacts of development in areas of deep-aquifer drawdown
2. Refine impervious cover evaluation to include impacts on existing higher quality watersheds
3. Update terrestrial resource evaluation based on emerging inventory
 - a. Include the potential loss of ecosystem service values
 - b. Retain the impacts on restoration potential
4. Update environmental justice measurements to evaluate potential disparate impacts on accessibility and pollution exposure

1. Include impacts of development in areas of deep-aquifer drawdown.

CMAP's Water 2050 plan recognized that regional withdrawals from groundwater aquifers can exceed the recharge rate and pose adverse impacts for those existing and future populations relying on these resources for drinking water. A 2015 Illinois State Water Survey (ISWS) report identified areas within the region's sandstone aquifers at risk of partial or complete desaturation, largely due to withdrawal rates surpassing recharge rates.⁴

Since unannexed development in unincorporated areas is likely to rely on shallow groundwater instead of deep-aquifer groundwater, the main areas of concern are within or near the borders of communities that currently rely on sandstone aquifers. CMAP identified those communities

² The Green Infrastructure Vision 2.2 was used for the GO TO 2040 Plan update.

³ Impervious surface creation was estimated from a subzone-level statistical relationship between imperviousness in the 2006 National Land Cover Dataset and the density of households and jobs.

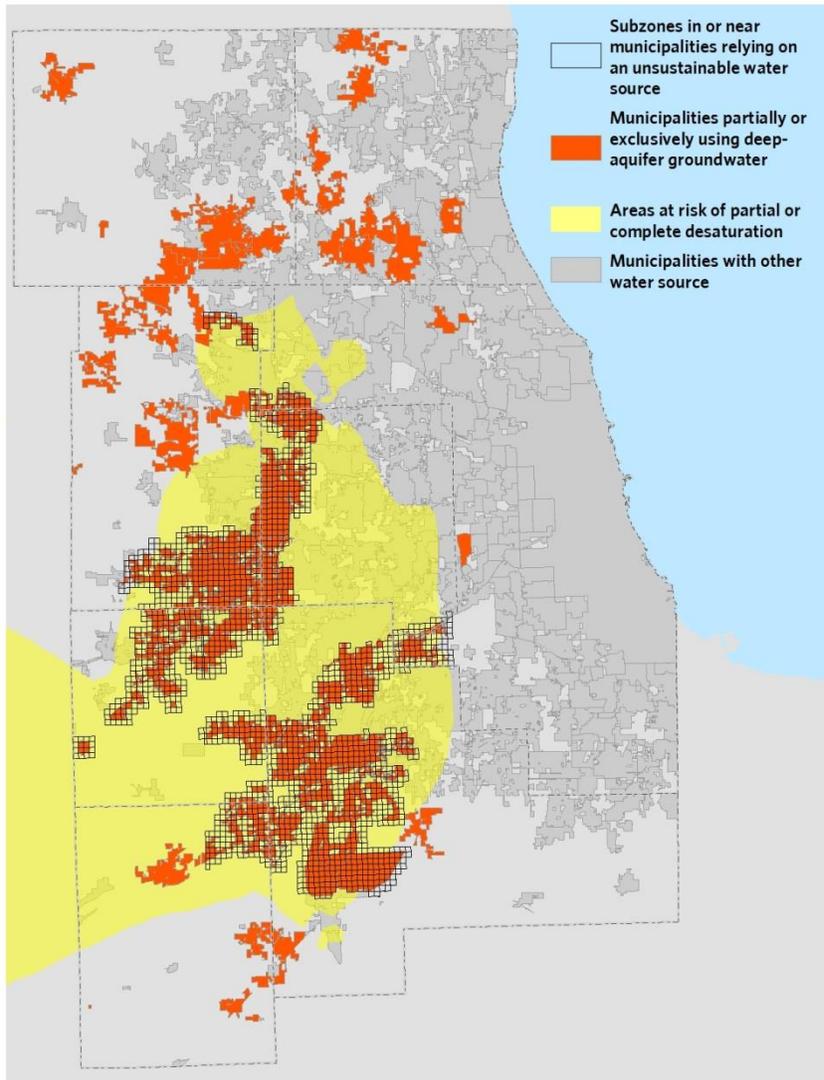
⁴ Daniel B. Abrams, et al. "Changing Groundwater Levels in the Sandstone Aquifers of Northern Illinois and Southern Wisconsin: Impacts on Available Water Supply" Illinois State Water Survey Prairie Research Institute Contract Report: 2015-02. Available at:

<http://www.isws.illinois.edu/pubs/pubdetail.asp?CallNumber=ISWS+CR+2015-02>



then overlaid them with the Illinois State Water Survey data on desaturation risk to identify areas where new development could lead to increased water demands on a compromised drinking water source (Figure 1). Using the existing accessibility-based spinoff development method described above, CMAP can estimate the number of households that might locate in these areas as a result of a proposed transportation project.

Figure 1. Subzones relying on a compromised water source



Source: 2015 Illinois State Water Survey and CMAP



2. Refine impervious cover evaluation to include impacts on existing higher quality watersheds

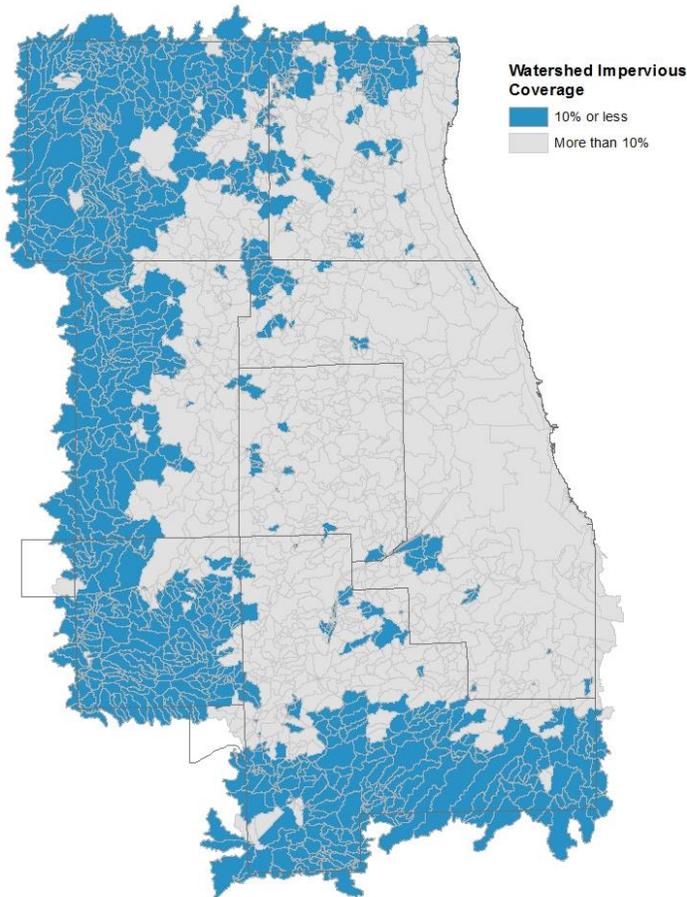
For a regional indicator, impervious cover continues to be an important evaluation tool for water resource degradation and public health impacts. Measures of impervious cover change are a proxy measure of water pollution, erosion, and the urban heat island effect. The impervious cover model (ICM) was first proposed by Schueler (1994) and subsequently reformulated (Schueler 2009) as a management tool to diagnose the severity of future stream problems in urban subwatersheds. Subwatersheds with less than five to -10 percent impervious cover tend to maintain the health of streams within them.⁵

Building off past evaluation methods, CMAP can connect the amount of impervious cover generated by both the footprint of the proposed transportation project and the potential increased development due to enhanced accessibility to the corresponding subwatershed and its impervious conditions. The potential for additional impervious coverage in the region's existing, higher quality subwatersheds -- those with less than 10% existing impervious cover (Figure 2) -- would be tracked and compared between proposed projects. This metric would supplement, not replace the existing impervious cover metric.

⁵ Schueler, Thomas R., et al. "Is Impervious Cover Still Important? Review of Recent Research" Journal of Hydrologic Engineering, Vol. 14, No. 4, April 2009.



Figure 2. Percent Impervious Cover by sub-watershed



Note: Analysis would include only sub-watersheds of 12,000 acres or less since the Impervious Cover Model is less applicable at larger scales..

Source: National Hydrography Dataset Plus v2 and 2011 National Land Cover Dataset

3. Update terrestrial resource evaluation based on emerging inventory.

As part of the next regional planning process, CMAP has identified the need to update the spatial datasets that were used to create the Green Infrastructure Vision (GIV), a regional map that synthesizes ecological and conservation data. New datasets, many at higher resolution with more parameters, have been developed and can provide more guidance to implementers. While the exact form and extent of this updated natural resource inventory is still emerging, this analysis of major capital projects should evolve as well to take advantage of refined data.

Overall, future analysis should strive to maintain the existing terrestrial resource evaluation methodology that was done for the GO TO 2040 Plan update, which identified the change in households for those subzones that had a majority amount of land (at or above 50 percent) identified as within the current GIV. However, instead of the existing GIV, the analysis should use some or all of the datasets in the natural resource inventory. At the same time, this



evaluation needs to be cognizant of potential changes to the inventory that may warrant different steps for this analysis:

a. *Include the monetary value of potential ecosystem services loss*

Ecosystem services are the collective benefits from an array of resources and processes that are supplied by nature and can be compromised or lost with development. In 2014, CMAP released a study of the value of ecosystem services currently being provided by the core landscape types⁶ within the GIV. The study found that six ecosystem services (water flow regulation/flood control, water purification, groundwater recharge, carbon storage, native flora and fauna, and recreation and ecotourism) contribute well over \$6 billion per year in economic value to the 7-county CMAP region.

This data provides a new way to understand the loss of terrestrial resources. While the format of the natural resource inventory is evolving, ecosystem service valuation should be included in some manner. For those projects that are projected to bring new households in subzones with a majority of their land in core landscape types, the corresponding dollar value of the ecosystem services that could be impacted by that new development could be tallied.

b. *Retain the impacts on restoration potential.*

Habitat fragmentation is the process by which habitat loss results in the division of large, continuous habitats into smaller, more isolated remnants, which has substantial impacts on biodiversity and ecosystem functioning. Much of the existing habitat in the Chicago region has already experienced significant habitat fragmentation -- which has led CMAP and partners to identify goals of preserving existing habitats and restoring the connections between remnant natural lands.

In addition to identifying core landscape types, the GIV also provides a vision for areas that could be connected and restored. By using the GIV the current evaluation estimates the impact of potential new development on both existing habitat connectivity and on plans to restore larger and more connected habitats. If the future natural resource inventory includes a vision component that identifies areas that could connect habitats together, existing methods can continue to be used. If these areas are not included in the natural resources inventory, the subzone analysis described above should be modified to include a measurement of potential development in subzones that border core landscape types and other priority areas identified in the planning process.

⁶ The core landscape types and corresponding data layers are identified in Table 6, GIV 2.3 Ecosystem Service Valuation. Available: <https://datahub.cmap.illinois.gov/dataset/c303fd2e-beaf-4a75-a9ec-b27c6da49b69/resource/028c9b69-bb19-425e-bb92-3d33656bea4c/download/tcfcmapgiv23ecosystemservicesfinalreport201412v2.pdf>



4. Update environmental justice measurements to evaluate potential disparate impacts on accessibility and pollution exposure.

The US EPA defines the goal of environmental justice work as ensuring that “everyone enjoys the same degree of protection from environmental and health hazards and equal access to the decision-making process to have a healthy environment in which to live, learn, and work.” As part of the development process for the next comprehensive regional plan, CMAP staff is working on strategy papers on regional resilience to climate change and approaches to inclusive growth. Through these papers, CMAP is developing a methodology for identifying places in the region that are of particular concern when considering environmental impacts. The major capital project evaluation process should use the same methodology to define its environmental justice population.

Federal regulations require CMAP to evaluate the potential environmental justice implications of comprehensive regional plans. In order to fully understand the environmental justice impacts of major capital projects, it is important to analyze not only what impact the project has on identified environmental justice populations, but also to what degree the project impacts those populations differently from non-environmental justice populations. The same metric employed in the 2040 plan major capital evaluation process can be used to identify any potential disparate impacts by comparing changes in accessibility in environmental justice zones to the changes in accessibility of non-environmental justice zones.

While changes in the accessibility of work destinations is an important measure of regional equity, from an environmental and public health perspective it is also important to measure disparate exposure to pollution. As a proxy for air pollution emissions, existing methods for calculating congested vehicle hours traveled at the regional and corridor level should be used to calculate the change in congested vehicle hours traveled in environmental justice communities versus non-environmental justice communities.

Future needs

Other important environmental impacts were identified, yet available data or analytical capacity limits their inclusion in this evaluation. As information is updated, the environmental evaluation may be able to include the following:

Urban flooding. Much is known about the locations of riverine flooding within the region. Because the current analysis of major capital projects estimates development within the GIV, which includes undeveloped floodplains, it identifies some new development that is likely to experience or contribute to flooding issues. CMAP is currently in the process of developing regional data to identify areas of the region that are more vulnerable to urban flooding. How a major capital project impacts or could be impacted by urban flooding could be assessed in a number of different ways. For example, it may be possible to calculate the change travel demand on roads that experience frequent flooding. Alternately, the spinoff development



method could be used to identify new development in areas experiencing high levels of urban flooding.

Sensitivity of shallow aquifers to contamination. Almost 20 percent of the region depends on the shallow and deep groundwater aquifers for drinking water. The new data on the deep aquifers provide CMAP with a way to account for potential future impacts on them, but less is known about the shallow aquifers which are more susceptible to contamination. Ideally, development would be limited in sensitive aquifer recharge areas to reduce the amount of contamination that is often associated with urban development. Kane County and McHenry County have identified these areas, and digital models are being generated for Will and Lake County, but a region wide data source is not available at this time.

